

forming said ink nozzles to have a cross-sectional area less than a cross-sectional area of said ink passages.

10. A method for manufacturing a head for ink-jet printer according to claim 9, further comprising the step of:

forming a pitch of the ink nozzles at approximately 20  $\mu\text{m}$ .

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11. A head for ink-jet printer according to claim 1, wherein said ink passages have a cross-sectional area less than a cross-sectional area of said ink chambers, and wherein said ink nozzles have a cross-sectional area less than a cross-sectional area of said ink passages.

12. A head for ink-jet printer according to claim 1, wherein a pitch of the ink nozzles is approximately 20  $\mu\text{m}$ .

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#### REMARKS

Claims 1 and 3-12 are pending in this application. New claims 4-12 have been added. Care has been taken to avoid introduction of new matter.

Claims 1-3 are rejected under 35 U.S.C. § 112, second paragraph, as failing to particularly point out and distinctly claim the subject matter of the invention. Applicant respectfully submits that the amendments to claims 1-3 herein overcome this rejection and reconsideration is requested.

Claims 1-3 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Shimada** (U.S. Patent No. 5,825,121) in view of **JP 10-86365**. The Examiner is alleging **Shimada** provides ink nozzles 210, ink passages 204, ink chambers 203, and piezoelectric elements 208. The Examiner acknowledges **Shimada** does not provide piezoelectric elements comprising a thin film of a ferroelectric substance and relies upon **JP 10-86365** as providing a piezoelectric element comprising a thin film of a ferroelectric substance.

Claim 1 relates to a head for an ink-jet printer including a silicon substrate on which a plurality of ink nozzles and a plurality of ink passages, each communicating separately to each of the ink nozzles, processed finely using a plasma etching method. An inorganic substrate joined with the silicon substrate is provided with ink chambers, each communicating separately to each of the ink passages. A piezoelectric element of ferroelectric substance is provided to separately change a capacity of each of the ink chambers to jet ink from the ink nozzles through the ink chambers. The ink passages are fine as compared with the ink chambers and the ink nozzles are fine as compared with the ink passages. This construction permits formation of a high nozzle density structure within a small head (i.e., a fine spacing between nozzles) to permit a high print quality.

**Shimada**, in contrast, teaches that the ink channels 204 are formed in a joining region where a Si substrate 201 and a glass substrate 202 are joined (see, e.g., Fig. 2(b)). In contrast to the invention of claim 1, where the ink passages are fine as compared with the ink chambers and the ink nozzles are fine as compared with the ink passages, **Shimada** provide nozzles 210 having the same dimensions as the passages 204. **Shimada** provides no teaching or suggestion for this feature of claim 1.

**JP 10-86365** provides an ink chamber 12 formed in a joining region where the ink chamber forming member 11 and a diaphragm 18 of ceramic are joined. However, it is similarly unable to provide any teaching or suggestion of ink passages that are fine as compared with the ink chambers and the ink nozzles that are fine as compared with the ink passages.

Further, claim 3 provides a method for manufacturing a head for an ink-jet printer including the steps of introducing a photosensitive group into a precursor sol of ferroelectric substance formed by sol-gel method, forming a thin film of ferroelectric substance gel by applying the precursor sol to a base, and forming the piezoelectric element of ferroelectric substance by applying a fine patterning to the thin film of ferroelectric substance gel through optical fabrication. In contrast, **Shimada** teaches that a PZT film is formed through RF magnetron sputtering and **JP 10-86365** provides that a thin film of ferroelectric substance is formed through a sol-gel method. However, neither applied reference suggests or provides forming the piezoelectric element of ferroelectric substance by applying a fine patterning to the thin film of ferroelectric substance gel through optical fabrication.

Therefore, the combination of **Shimada** and **JP 10-86365** fails to teach or suggest each and every element of independent claims 1 or 3, or claims dependent thereon. Reconsideration and withdrawal of this 35 U.S.C. § 103 rejection is respectfully requested for at least the above reasons.

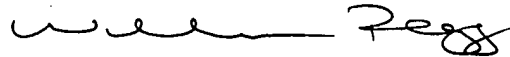
Additionally, it is submitted that new claims 4-12 are patentable over the applied references and allowance thereover is requested. For example, with respect to the apparatus claims, claim 4 recites ink nozzles with tapered configurations, claim 5 recites

the silicon substrate has a construction in which plural silicon substrates are laminated, and claim 6 requires communication between the ink nozzles and ink passages by laminating the silicon substrate in which the ink nozzles are processed and the silicon substrate in which the ink passages are processed. In claim 11, the ink passages have a cross-sectional area less than a cross-sectional area of the ink chambers and the ink nozzles have a cross-sectional area less than a cross-sectional area of the ink passages. With respect to the method claims, claim 9 similarly recites forming the ink passages to have a cross-sectional area less than a cross-sectional area of the ink chambers and forming the ink nozzles to have a cross-sectional area less than a cross-sectional area of the ink passages.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "William D. Pegg", with a checkmark to its right.

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